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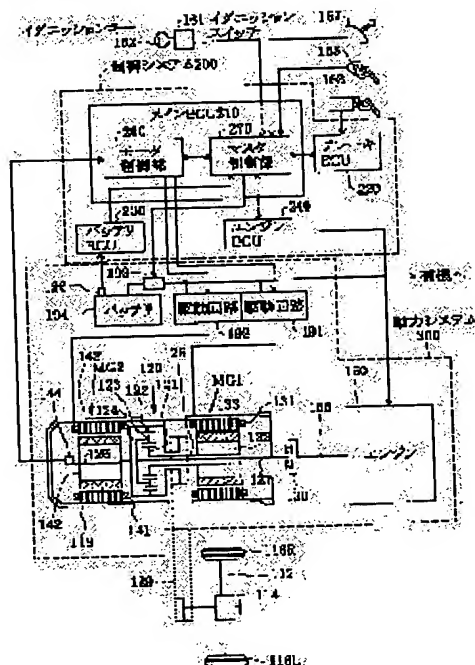
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(54) MOVING OBJECT AND CONTROLLING METHOD THEREOF

(57)Abstract:

PROBLEM TO BE SOLVED: To extend traveling range if the charging amount of secondary battery has decreased because of the occurrence of an abnormality in an engine, a first motor or the like.

SOLUTION: An abnormality detection discriminating part 272a discriminates whether or not an abnormality of an engine 150, a motor MG1 and the like is detected. A state-of-charge discriminating part 272b discriminates whether or not the state of charge SOC of a battery 194 has decreased to a given value S_{re} or lower. If it is equal to or lower than the given value S_{re} , a motor power performance decreasing part 272c obtains the maximum number of revolutions R_{max} of a motor MG2 from a prepared map based on the SOC. The maximum number of the revolutions R_{max} is set in such a way as to decline proportionally as the SOC of the battery 194 decreases. The motor power performance decreasing part 272c discriminates whether or not the number of revolution $REV2$ of a motor MG2 is exceeding the R_{max} . If it is equal to or larger than the R_{max} , the target torque $T2_{tag}$ of the motor MG2 is calculated so as to equalize the $REV2$ with the R_{max} and to output $T2_{req}=T2_{tag}$ as a torque command value with regard to the motor MG2 to a motor main control CPU 262.



LEGAL STATUS

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CLAIMS

[Claim(s)]

[Claim 1] The engine which has an output shaft, the driving shaft for outputting power, and the 1st motor combined with said output shaft, Between the 2nd motor combined with said driving shaft, and said 1st and 2nd motors, the rechargeable battery which can exchange power, It is the mobile which equips said engine, said 1st and 2nd motors, and a list with the control unit which can control said rechargeable battery. Said control unit When the abnormalities relevant to said engine or said 1st motor are detected, while controlling to operate only said 2nd motor among said 1st and 2nd motors in said engine and a list The mobile characterized by controlling said 2nd motor so that the power engine performance of said 2nd motor may be reduced according to reduction of said charge when the charge of said rechargeable battery is below a predetermined value after detecting said abnormalities.

[Claim 2] It is the mobile characterized by controlling said 2nd motor so that said control unit may reduce at least one of the maximum output of said 2nd motor, the maximum engine speed of said 2nd motor, and the maximum torque of said 2nd motor as power engine performance of said 2nd motor in a mobile according to claim 1.

[Claim 3] It is the mobile characterized by controlling said 2nd motor so that the power engine performance of said 2nd motor may not be reduced until the charge of said rechargeable battery becomes said below predetermined value, after said control unit detects said abnormalities in a mobile according to claim 1 or 2.

[Claim 4] It is the mobile characterized by not being concerned with reduction of said charge and not reducing the power engine performance of said 2nd motor any more after said control unit reduces the power engine performance of said 2nd motor to predetermined extent in the mobile of one publication of the arbitration of claim 1 thru/or the claims 3.

[Claim 5] It is the mobile characterized by controlling said 2nd motor so that the power engine performance of said 2nd motor may not be reduced when said 2nd motor performs regeneration actuation even if it is the case where the charge of said rechargeable battery is said below predetermined value after said control unit detects said abnormalities in the mobile of one publication of the arbitration of claim 1 thru/or the claims 4.

[Claim 6] The engine which has an output shaft, the driving shaft for outputting power, and the 1st motor combined with said output shaft, Between the 2nd motor combined with said driving shaft, and said 1st and 2nd motors, the rechargeable battery which can exchange power, The process which is the control approach of preparation ***** and detects the abnormalities relevant to the (a) aforementioned engine or said 1st motor, (b) The process controlled to operate only said 2nd motor among said 1st and 2nd motors in said engine and a list when said abnormalities are detected at said process (a), (c) The process which judges whether the charge of said rechargeable battery is below a predetermined value after detecting said abnormalities at said process (a), (d) The control approach of the mobile equipped with the process which controls said 2nd motor so that the power engine performance of said 2nd motor may be reduced according to reduction of said charge when it judges with said charge being below a predetermined value at said process (c).

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the control technique of the 2nd motor at the time of producing abnormalities on an engine or the 1st motor especially about mobiles, such as a hybrid car equipped with an engine, the 1st motor, and the 2nd motor.

[0002]

[Description of the Prior Art] In recent years, the hybrid car which makes an engine and a motor the source of power is proposed, and it has the so-called parallel hybrid car as a kind of a hybrid car (for example, technique given in JP,9-47094,A etc.). By the parallel hybrid car, when the power outputted from the engine minds the power adjusting device which has the 1st motor, the part is transmitted to a driving shaft and residual power is revived as power by the 1st motor. A dc-battery charges or this power is used for driving the 2nd motor as sources of power other than an engine. Such a hybrid car can output the power outputted from the engine to a driving shaft with the rotational frequency and torque of arbitration by controlling the 1st and 2nd motors in the transfer process of above-mentioned power. It is not concerned with the demand output which should be outputted from a driving shaft, but since an engine can choose the high operation point of operation effectiveness and can be operated, the hybrid car is excellent in saving-resources nature and exhaust air purification nature compared with the conventional car which makes only an engine a driving source.

[0003]

[Problem(s) to be Solved by the Invention] In such a hybrid car, when abnormalities arise on an engine, the 1st motor, etc. which were mentioned above, it becomes impossible to make it run a car by making an engine 150 into the source of power so that it may mention later. Since it also becomes impossible to revive power by the 1st motor, it also becomes impossible moreover, to charge power at a dc-battery. If the charge of a dc-battery decreases in a such case, how it is made to run a hybrid car, extending mileage will pose a problem.

[0004] In addition, as a thing relevant to this kind of technique, the thing of a publication mentions to JP,10-248104,A and it is *****, for example. When the charge of a dc-battery decreases in the electric vehicle which makes only a motor the source of power in this proposed example and transit almost becomes impossible, it is made movable [short distance] so that it may not become an obstacle of other cars, a pedestrian, etc.

[0005] The purpose of this invention is to offer the mobile which can extend migration length, and its control approach, when the trouble of the above-mentioned conventional technique is solved, abnormalities occur on an engine, the 1st motor, etc. and the charge of a rechargeable battery is decreasing.

[0006]

[The means for solving a technical problem, and its operation and effectiveness] In order to attain a part of above-mentioned purpose [at least], the mobile of this invention The engine which has an output shaft, the driving shaft for outputting power, and the 1st motor combined with said output shaft,

Between the 2nd motor combined with said driving shaft, and said 1st and 2nd motors, the rechargeable battery which can exchange power, It is the mobile which equips said engine, said 1st and 2nd motors, and a list with the control unit which can control said rechargeable battery. Said control unit When the abnormalities relevant to said engine or said 1st motor are detected, while controlling to operate only said 2nd motor among said 1st and 2nd motors in said engine and a list When the charge of said rechargeable battery is below a predetermined value after detecting said abnormalities, let it be a summary to control said 2nd motor so that you may reduce the power engine performance of said 2nd motor according to reduction of said charge.

[0007] Moreover, the engine with which the control approach of this invention has an output shaft and the driving shaft for outputting power, The 1st motor combined with said output shaft, and the 2nd motor combined with said driving shaft, Between said 1st and 2nd motors, the rechargeable battery which can exchange power, The process which is the control approach of preparation ***** and detects the abnormalities relevant to the (a) aforementioned engine or said 1st motor, (b) The process controlled to operate only said 2nd motor among said 1st and 2nd motors in said engine and a list when said abnormalities are detected at said process (a), (c) The process which judges whether the charge of said rechargeable battery is below a predetermined value after detecting said abnormalities at said process (a), (d) When you judge with said charge being below a predetermined value at said process (c), let it be a summary to have the process which controls said 2nd motor so that you may reduce the power engine performance of said 2nd motor according to reduction of said charge.

[0008] When abnormalities arise in relation to an engine or the 1st motor, a mobile cannot be moved by making an engine into the source of power. So, when the abnormalities relevant to an engine or the 1st motor are detected, only the 2nd motor is controlled by the mobile or the control approach of this invention to operate. Moreover, when abnormalities arise in relation to an engine or the 1st motor, power can be revived by the 1st motor and a rechargeable battery cannot be made to charge. So, when the charge of a rechargeable battery is below a predetermined value after detecting abnormalities, the 2nd motor is controlled by the mobile or the control approach of this invention to reduce the power engine performance of the 2nd motor according to reduction in a charge.

[0009] Therefore, since the power engine performance of the 2nd motor is reduced according to reduction in a charge even when according to the mobile or the control approach of this invention the abnormalities relevant to an engine or the 1st motor occur and the charge of a rechargeable battery is decreasing, power consumed by the part and the 2nd motor can be lessened. Since the rate that the charge of a rechargeable battery decreases also becomes loose by this, the migration length of the part and a mobile is extended and the thing of it can be carried out.

[0010] In the mobile of this invention, as power engine performance of said 2nd motor, as for said control unit, it is desirable to control said 2nd motor so that at least one of the maximum output of said 2nd motor, the maximum engine speed of said 2nd motor, and the maximum torque of said 2nd motor may be reduced.

[0011] Thus, as power engine performance of the 2nd motor, the power consumed by the 2nd motor can be stopped by controlling the 2nd motor so that at least one of the maximum output of the 2nd motor, the maximum engine speed of said 2nd motor, and the maximum torque of said 2nd motor may be reduced.

[0012] In the mobile of this invention, as for said control unit, it is desirable to control said 2nd motor so that the power engine performance of said 2nd motor may not be reduced, until the charge of said rechargeable battery becomes said below predetermined value, after detecting said abnormalities.

[0013] Thus, when the abnormalities which compared the mobile and were described above during migration by constituting occur and the charge of a rechargeable battery exceeds the above-mentioned predetermined value, since the power engine performance of the 2nd motor is not reduced, it becomes movable as a demand of an operator succeedingly, and urgent evasion can be performed smoothly.

[0014] In the mobile of this invention, after said control unit reduces the power engine performance of said 2nd motor to predetermined extent, it is desirable for it not to be concerned with reduction of said charge and not to reduce the power engine performance of said 2nd motor any more.

[0015] Thus, by constituting, reducing the power engine performance of the 2nd motor beyond the need is lost, and it becomes possible to guarantee minimum migration of a mobile.

[0016] In the mobile of this invention, when said 2nd motor performs regeneration actuation even if it is the case where the charge of said rechargeable battery is said below predetermined value after detecting said abnormalities, as for said control unit, it is desirable to control said 2nd motor so that the power engine performance of said 2nd motor may not be reduced.

[0017] thus, when the abnormalities relevant to an engine or the 1st motor occur, the charge of a rechargeable battery is decreasing and the 2nd motor performs regeneration actuation Since the 2nd motor can usually perform regeneration actuation by the power engine performance of a passage by making it not reduce the power engine performance of the 2nd motor, power can fully be revived, the revived power can be charged at a rechargeable battery, and the charge of a rechargeable battery can be raised.

[0018]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained in order of the following based on an example.

A. motor transit [at the time of the configuration D. malfunction detection of the basic actuation C. control system of the whole hybrid car configuration B. hybrid car]: -- configuration [of a D-1. control unit]: -- motor transit control processing [at the time of D-2. malfunction detection]: -- E. modification E-1. modification 1:E-2. modification 2: -- E-3. modification 3:E-4. modification 4: [0019] A. The whole hybrid car configuration : drawing 1 is the explanatory view showing the whole hybrid car configuration containing the shift control device as one example of this invention. This hybrid car is equipped with an engine 150, the two a motor/generators MG1 and MG2, and three prime movers of **. Here, "the motor/generator" means the prime mover which functions also as a motor and functions also as a generator. In addition, below, since it is easy, these are only called a "motor." Control of a car is performed by the control system 200.

[0020] The control system 200 has Maine ECU 210, the brake ECU 220, the dc-battery ECU 230, and the engine ECU 240. Each ECU is constituted as one unit by which two or more circuit elements, such as a microcomputer, and an input interface, an output interface, have been arranged on the one circuit board. Maine ECU 210 has the motor control section 260 and the master control section 270. The master control section 270 has the function to determine controlled variables, such as allocation of three prime movers 150 and the output of MG1 and MG2.

[0021] The power system 300 has an engine 150, motors MG1 and MG2, the drive circuit 191,192, the system main relay 193, and a dc-battery 194.

[0022] An engine 150 is the usual gasoline engine and rotates a crankshaft 156. Operation of an engine 150 is controlled by the engine ECU 240. An engine ECU 240 performs control of the fuel oil consumption and others of an engine 150 according to the command from the master control section 270.

[0023] Motors MG1 and MG2 are constituted as a synchronous motor, and are equipped with Rota 132,142 which has two or more permanent magnets in a peripheral face, and the stator 133,143 around which the three phase coil 131,141 which forms rotating magnetic field was wound. The stator 133,143 is being fixed to the case 119. The three phase coil 131,141 wound around the stator 133,143 of motors MG1 and MG2 is connected to the dc-battery 194 through the system main relay 193 through the drive circuit 191,192, respectively. The system main relay 193 is a relay switch which performs connection or separation with a dc-battery 194 and the drive circuit 191,192. The system main relay 193 is controlled by the master control section 270. Moreover, the power from a dc-battery 194 is supplied also to auxiliary machinery (not shown) through the system main relay 193.

[0024] The drive circuit 191,192 is the transistor inverter which it equipped with one pair of transistor as a switching element at a time for every phase. The drive circuit 191,192 is controlled by the motor control section 260. If the transistor of the drive circuit 191,192 is switched by the control signal from the motor control section 260, a current will flow between a dc-battery 194 and motors MG1 and MG2. Motors MG1 and MG2 can also operate as a motor which carries out a rotation drive in response to

supply of the power from a dc-battery 194, when Rota 132,142 is rotating according to external force (this operating state is hereafter called power running), can function as a generator which makes the both ends of the three phase coil 131,141 produce electromotive force, and can also charge a dc-battery 194 (this operating state is hereafter called regeneration).

[0025] The revolving shaft of an engine 150 and motors MG1 and MG2 is mechanically combined through planetary gear 120. the planetary carrier 124 with which planetary gear 120 have a sun gear 121, a ring wheel 122, and the planetary pinion gear 123 -- since -- it is constituted. By the hybrid car of this example, the crankshaft 156 of an engine 150 is combined with the planetary carrier shaft 127 through the damper 130. The damper 130 is formed in order to absorb twist vibration produced in a crankshaft 156. Rota 132 of a motor MG 1 is combined with the sun gear shaft 125. Rota 142 of a motor MG 2 is combined with the ring wheel shaft 126. Rotation of a ring wheel 122 is transmitted to an axle 112 and Wheels 116R and 116L through a chain belt 129 and a differential gear 114.

[0026] Various sensors are used for the control system 200 in order to realize control of the whole car. For example The amount of treading in of the accelerator by the operator The accelerator sensor 165 for detecting, the location of a shift lever A (shift position) The dc-battery sensor 196 for detecting the brake sensor 163 for detecting the shift position sensor 167 and the treading-in pressure of a brake to detect and the charge condition of a dc-battery 194 and the rotational frequency of a motor MG 2 are used for the rotational frequency sensor 144 of a measurement sake etc. Since it is mechanically combined with the chain belt 129, the ratio of the rotational frequency of the ring wheel shaft 126 and an axle 112 of the ring wheel shaft 126 and an axle 112 is fixed. Therefore, not only the rotational frequency of a motor MG 2 but the rotational frequency of an axle 112 is detectable by the rotational frequency sensor 144 formed in the ring wheel shaft 126. Moreover, although it is not a sensor, the ignition switch 161 for performing starting/halt of the power system 300 etc. is used by turning an ignition key 162.

[0027] B. Fundamental actuation of a hybrid car : in order to explain fundamental actuation of a hybrid car, below, explain actuation of planetary gear 120 first. Planetary gear 120 have the property in which the rotational frequency of the remaining revolving shaft is decided, if the rotational frequency of two of three revolving shafts mentioned above is determined. The relation of the rotational frequency of each revolving shaft is as a degree type (1).

[0028]

$$N_c = N_s \rho / (1 + \rho) + N_r / (1 + \rho) \quad \text{-- (1)}$$

[0029] Here, N_c is [the rotational frequency of the sun gear shaft 125 and N_r of the rotational frequency of the planetary carrier shaft 127 and N_s] the rotational frequencies of the ring wheel shaft 126.

Moreover, ρ is the gear ratio of a sun gear 121 and a ring wheel 122 as it is expressed with a degree type.

$$\rho = [\text{number of teeth of sun gear 121}] / [\text{the number of teeth of a ring wheel 122}]$$

[0031] Moreover, the torque of three revolving shafts is not concerned with a rotational frequency, but has the fixed relation given by the degree type (2) and (3).

[0032]

$$T_s = T_c \rho / (1 + \rho) \quad \text{-- (2)}$$

$$T_r = T_c / (1 + \rho) = T_s / \rho \quad \text{-- (3)}$$

[0033] Here, T_c is [the torque of the sun gear shaft 125 and T_r of the torque of the planetary carrier shaft 127 and T_s] the torque of the ring wheel shaft 126.

[0034] The hybrid car of this example can run in the various condition by the function of such planetary gear 120. For example, where [comparatively low speed] transit is begun, while the hybrid car had suspended the engine 150, it transmits and runs power to an axle 112 by acting as the power running of the motor MG 2. It may run carrying out idle operation of the engine 150 similarly.

[0035] If a hybrid car reaches a predetermined rate after transit initiation, by the torque outputted by acting as the power running of the motor MG 1, a control system 200 will carry out motoring of the engine 150, and will start. At this time, the reaction force torque of a motor MG 1 is outputted also to a ring wheel 122 through planetary gear 120.

[0036] If an engine 150 is operated and the planetary carrier shaft 127 is rotated, the sun gear shaft 125

and the ring wheel shaft 126 will rotate under the conditions with which are satisfied of upper type (1) - (3). The power by rotation of the ring wheel shaft 126 is transmitted to Wheels 116R and 116L as it is. The power by rotation of the sun gear shaft 125 can be revived as power by the 1st motor MG 1. On the other hand, if it acts as the power running of the 2nd motor MG 2, power can be outputted to Wheels 116R and 116L through the ring wheel shaft 126.

[0037] At the time of steady operation, the output of an engine 150 is set as a value almost equal to the demand power (namely, rotational frequency x torque of an axle 112) of an axle 112. At this time, a part of output of an engine 150 is told to the direct axle 112 through the ring wheel shaft 126, and the remaining output is revived as power by the 1st motor MG 1. Since the 2nd motor MG 2 generates the torque which rotates the ring wheel shaft 126, the revived power is used. Consequently, it is possible to drive an axle 112 with desired torque with a desired rotational frequency.

[0038] When the torque transmitted to an axle 112 runs short, torque is assisted by the 2nd motor MG 2. The power stored in the power and the dc-battery 149 which were revived by the 1st motor MG 1 is used for the power for this assistance. Thus, a control system 200 controls operation of two motors MG1 and MG2 according to the demand power which should be outputted from an axle 112.

[0039] The hybrid car of this example can also be gone astern, with the engine 150 operated. Operation of an engine 150 rotates the planetary carrier shaft 127 in the time of advance, and this direction. If the 1st motor MG 1 is controlled and the sun gear shaft 125 is rotated at a rotational frequency higher than the rotational frequency of the planetary carrier shaft 127 at this time, the ring wheel shaft 126 will be reversed in the go-astern direction a passage clear from an upper type (1). A control system 200 rotating the 2nd motor MG 2 in the go-astern direction, it can control the output torque and can reverse a hybrid car.

[0040] Planetary gear 120 are in the condition which the ring wheel 122 stopped, and can rotate the planetary carrier 124 and a sun gear 121. Therefore, an engine 150 can be operated also after the car has stopped. For example, if the charge of a dc-battery 194 decreases, a dc-battery 194 can be charged by operating an engine 150 and carrying out regeneration operation of the 1st motor MG 1. If it acts as the power running of the 1st motor MG 1 when the car has stopped, by the torque, motoring of the engine 150 can be carried out and it can start.

[0041] C. The configuration of a control system : drawing 2 is the block diagram showing the more detailed configuration of the control system 200 in an example. The master control section 270 includes master control CPU272 and the power control circuit 274. Moreover, the motor control section 260 has two motor control CPUs264,266 for controlling the motor main control CPU 262 and two motors MG1 and MG2, respectively. Each CPU is equipped with CPU, ROM and RAM, the input port, and the output port which are not illustrated, respectively, and constitutes 1 chip microcomputer with these.

[0042] Master control CPU272 controls starting of the power system 300, or determines controlled variables, such as three prime movers 150, a rotational frequency of MG1 and MG2, and allocation of torque, supplies various kinds of desired value to other CPUs and ECUs, and has the function which controls the drive of each prime mover. For this control, while the shift position signal SP 1 which shows the accelerator position signal AP which shows the ignition switch signal IG and accelerator opening, and a shift position, and SP2 grade are supplied, to system main relay 193 grade, a seizing signal ST is outputted to master control CPU272. In addition, the shift position sensor 167, the accelerator sensor 165, etc. are duplex-ized if needed.

[0043] The power control circuit 274 is a DC-DC converter for changing the high voltage direct current electrical potential difference of a dc-battery 194 into the low voltage direct current voltage for each circuits in Main ECU 210. This power control circuit 274 also has the function as a supervisory circuit which supervises the abnormalities of master control CPU272.

[0044] An engine ECU 240 is the engine output request value PReq given from master control CPU272. It responds and an engine 150 is controlled. From an engine ECU 240, the engine speed REVen of an engine 150 is fed back to master control CPU272.

[0045] The motor main control CPU 262 supplies current desired value I1req and I2req to two motor control CPUs264,266 according to torque desired value T1req about the motors MG1 and MG2 given

from master control CPU272, and T2req, respectively. Motor control CPU264,266 controls the drive circuit 191,192 according to current desired value I1req and I2req, respectively, and drives motors MG1 and MG2. From the rotational frequency sensor of motors MG1 and MG2, the rotational frequencies REV1 and REV2 of motors MG1 and MG2 are fed back to the motor main control CPU 262. In addition, the engine speeds REV1 and REV2 of motors MG1 and MG2, the current value IB from the dc-battery 194 to the drive circuit 191,192, etc. are fed back to master control CPU272 from the motor main control CPU 262.

[0046] A dc-battery ECU 230 supervises the charge SOC of a dc-battery 194, and supplies it to master control CPU272. Master control CPU272 opts for the output of each prime mover in consideration of this charge SOC. That is, when charge is required, larger power than an output required for transit is made to output to an engine 150, and the part is distributed to the charge actuation by the 1st motor MG 1.

[0047] A brake ECU 220 performs control which balances the hydraulic brake which is not illustrated and the regenerative brake by the 2nd motor MG 2. This reason is that regeneration actuation by the 2nd motor MG 2 is performed, and a dc-battery 194 is charged by this hybrid car at the time of a brake. A brake ECU 220 is based on the brake pressure force BP from the brake sensor 163, and, specifically, is the regeneration desired value REGreq to master control CPU272. It inputs. Master control CPU272 is this desired value REGreq. It is based, opts for actuation of motors MG1 and MG2, and the regeneration effective value REGprac is fed back to a brake ECU 220. A brake ECU 220 is this regeneration effective value REGprac and the regeneration desired value REGreq. Based on difference and the brake pressure force BP, the amount of brakes by the hydraulic brake is controlled to a suitable value.

[0048] As mentioned above, master control CPU272 opts for each prime mover 150 and the output of MG1 and MG2, and supplies desired value to ECU240 and CPU264,266 which take charge of each control. ECU240 and CPU264,266 control desired value ***** each of this prime mover.

Consequently, a hybrid car can output and run suitable power from an axle 112 according to a run state. Moreover, at the time of a brake, a brake ECU 220 and master control CPU272 cooperate, and actuation of each prime mover or a hydraulic brake is controlled. Consequently, braking for which an operator is not made to sense sense of incongruity not much is realizable, reviving power.

[0049] Four CPUs272,262,264,266 supervise mutual abnormalities using the so-called watch locking-dog pulse WDP, and when abnormalities occur in CPU and a watch locking-dog pulse stops, they have the function to make the CPU supply and reset reset-signal RES. In addition, the abnormalities of master control CPU272 are supervised by the power control circuit 274.

[0050] The hysteresis of the abnormal occurrence of the accelerator sensor 165 or the shift position sensor 167 is registered into the abnormality hysteresis registration circuit 280. Moreover, the reset signals RES1 and RES2 transmitted and received between master control CPU272 and the motor main control CPU 262 are inputted into the input port of the abnormality hysteresis registration circuit 280. The abnormality hysteresis registration circuit 280 stores this in internal memory, if these reset signals RES1 and RES2 occur.

[0051] In addition, master control CPU272 and the abnormality hysteresis registration circuit 280 can perform various kinds of demands and notices mutually through the two-way communication wiring 214. Moreover, the two-way communication wiring 212 is formed also between master control CPU272 and the motor main control CPU 262.

[0052] D. motor transit [at the time of malfunction detection]: -- configuration [of a D-1. control unit]: -- drawing 3 is the block diagram showing the configuration of the control unit for controlling the motor transit at the time of malfunction detection. Master control CPU272 has the function as malfunction detection judging section 272a, the function as charge judging section 272b, and the function as motor power engine-performance reduction section 272c. Malfunction detection judging section 272a judges whether malfunction detection was carried out in relation to the engine 150 or the motor MG 1 based on the signal outputted from an engine ECU 240 or the motor main control CPU 262. Charge judging section 272b judges whether the charge SOC of a dc-battery 194 became below a predetermined value based on the signal outputted from the dc-battery ECU 230. When abnormalities are detected and

Charge SOC becomes below a predetermined value, motor power engine-performance reduction section 272c takes out directions of motor control to the motor main control CPU 262 so that the power engine performance of the 2nd motor may be reduced.

[0053] D-2. Motor transit control processing at the time of malfunction detection : drawing 4 is a flow chart which shows the procedure of the motor transit control processing at the time of the malfunction detection by the control device shown in drawing 3 . When the processing shown in drawing 4 is started, malfunction detection judging section 272a of master control CPU272 Input the signal outputted from an engine ECU 240, and the signal outputted from the motor main control CPU 262, and it carries out based on these signals. [whether malfunction detection was carried out about the part (for example, the engine ECU 240) relevant to engine 150 the very thing or it, and] Or it judges whether malfunction detection was carried out about the parts (for example, the drive circuit 191, 1st motor control CPU264, etc.) relevant to motor MG1 the very thing or it (step S102). And when it judges with malfunction detection being carried out about neither, by the usual processing, master control CPU272 computes torque desired value T1req about the engine output request value PEreq and motors MG1 and MG2, and T2req, and gives them to an engine ECU 240 and the motor main control CPU 262. On the other hand, when it judges with malfunction detection having been carried out about either, master control CPU272 performs processing at the time of malfunction detection which is mentioned later.

[0054] When abnormalities occur on an engine 150, a motor MG 1, etc., the following faults arise by the hybrid car. That is, if abnormalities occur into an engine 150 or the part relevant to it, since an engine 150 will carry out a urinal stall, by the hybrid car, the transit which made the engine 150 the source of power will be impossible.

[0055] Moreover, since on-off operation of the engine 150 is carried out, even if it is under transit, an engine 150 may stop, but also when abnormalities occur into a motor MG 1 or the part relevant to it during such an engine shutdown, the transit which made the engine 150 the source of power will become impossible by the hybrid car.

[0056] It is because it becomes impossible [the dc-battery loess transit by reverse ***** which used the engine 150 since it became impossible to put an engine 150 into operation by motoring already according to a motor MG 1 if abnormalities occur during an engine shutdown at motor MG1 grade, although the dc-battery loess transit by reverse ***** if the engine is operating even if abnormalities arise in motor MG1 grade by the hybrid car is possible].

[0057] Since it also becomes impossible to revive power by the motor MG 1, it will also become impossible moreover, to charge power by the hybrid car at a dc-battery 194, if abnormalities occur on an engine 150, a motor MG 1, etc.

[0058] Then, in order to cope with such fault, when it judges with malfunction detection having been carried out in step S102, as for master control CPU272, based on the signal with which charge judging section 272b was outputted from the dc-battery ECU 230, the charge SOC of a dc-battery 194 judges first whether it became below the predetermined value Sre (step S106). Without preparing a limit in any way, since there are sufficient allowances for a dc-battery 194 if the charge SOC of a dc-battery 194 has exceeded the predetermined value Sre, a motor MG 2 is driven using the power stored in the dc-battery 194, and it is made to perform motor transit by the motor MG 2.

[0059] Motor power engine-performance reduction section 272c computes the demand output Ptag demanded by the operator based on the accelerator position signal AP outputted from the accelerator sensor 165, and, specifically, computes the computed demand output Ptag to the value of the rotational frequency REV2 of the motor MG 2 outputted from the motor main control CPU 262, and the demand torque Ttag further (step S108). Since the rotational frequency REV2 of a motor MG 2 is proportional to the rotational frequency of an axle 112, as a result the vehicle speed, it can compute the demand torque Ttag demanded by the operator as a quotient of the demand output Ptag and the present rotational frequency REV2.

[0060] Next, while motor power engine-performance reduction section 272c outputs PEreq=0 as an engine output request value to an engine ECU 240, to the motor main control CPU 262, as a torque command value about a motor MG 1, it outputs T1req=0 and outputs T2 req=Ttag as a torque command

value about a motor MG 2.

[0061] Thereby, both the engine 150 and the motor MG 1 will be in a idle state, and they are controlled so that a motor MG 2 outputs Torque Ttag. Consequently, by the motor MG 2, motor transit will be carried out and, moreover, a hybrid car can take out the output as a demand of an operator.

[0062] On the other hand, in step S106, since there are no allowances in a dc-battery 194 so much when the charge SOC of a dc-battery 194 is below the predetermined value Sre, after stopping the power consumed by the motor MG 2, it is made to prepare a limit which is mentioned later, and to perform motor transit by the motor MG 2.

[0063] It asks for the maximum engine speed Rmax of a motor MG 2 from the map on which motor power engine-performance reduction section 272c was specifically beforehand prepared based on the charge SOC of the dc-battery 194 obtained from charge judging section 272b (step S112).

[0064] An example of the map which expresses the relation between the charge SOC of such a dc-battery 194 and the maximum engine speed Rmax of a motor MG 2 to drawing 5 is shown. In drawing 5, an axis of abscissa is the charge SOC of a dc-battery 194, and an axis of ordinate is the maximum engine speed Rmax of a motor MG 2. As shown in drawing 5, when the charge SOC of a dc-battery 194 has exceeded the predetermined value Sre, the rotational frequency REV2 of a motor MG 2 is not restricted at all, but as for the case below the predetermined value Sre, maximum engine speed Rmax is set up, and the rotational frequency REV2 of a motor MG 2 is restricted to below the maximum engine speed Rmax so that it may mention later. And the maximum engine speed Rmax is set up so that it may fall in proportion to the charge SOC of a dc-battery 194 decreasing. And finally, if the maximum engine speed Rmax becomes the predetermined value Rremin, even if Charge SOC decreases, it will not fall any more any longer.

[0065] In this way, from a map as shown in drawing 5, if it asks for the maximum engine speed Rmax of a motor MG 2 next, motor power engine-performance reduction section 272c will judge whether the value of the rotational frequency REV2 of the motor MG 2 outputted from the motor main control CPU 262 has exceeded the maximum engine speed Rmax for which it asked (step S114). Since it is in a limit when the value of the rotational frequency REV2 of a motor MG 2 is below the maximum engine speed Rmax as a result of a judgment, it is satisfactory even if it takes out the output as a demand of an operator. Therefore, motor power engine-performance reduction section 272c processes steps S108 and S110 mentioned above, and performs motor transit with the output according to a demand of an operator.

[0066] However, when the value of the rotational frequency REV2 of a motor MG 2 has exceeded maximum engine speed Rmax as a result of the judgment, a motor MG 2 is controlled to come in a limit. Specifically, motor power engine-performance reduction section 272c computes target torque T2tag of the motor MG 2 by which the value of the rotational frequency REV2 of a motor MG 2 becomes equal to maximum engine speed Rmax first (step S116). For example, target torque T2tag of a motor MG 2 is computed according to the proportional integral used in proportional-plus-integral control (PI control). That is, target torque T2tag of a motor MG 2 is calculated from the sum of the proportional obtained multiplying the value of a rotational frequency REV2, and deflection with maximum engine speed Rmax by the predetermined proportionality constant, the integral term acquired multiplying the time quadrature value of the above-mentioned deflection by the predetermined proportionality constant, and **.

[0067] Next, while motor power engine-performance reduction section 272c outputs PReq=0 as an engine output request value to an engine ECU 240, to the motor main control CPU 262, as a torque command value about a motor MG 1, it outputs T1req=0 and outputs T2 req=T2tag as a torque command value about a motor MG 2.

[0068] Thereby, both the engine 150 and the motor MG 1 will be in a idle state, and are controlled to output torque T2tag whose motor MG 2 is target torque. Consequently, since the value of the rotational frequency REV2 of the motor MG 2 on which motor transit was carried out and the hybrid car had moreover exceeded maximum engine speed Rmax by the motor MG 2 is controlled to approach that maximum engine speed Rmax, though the operator is demanding the output beyond it, finally the value

of the rotational frequency REV2 of a motor MG 2 is restricted to below the maximum engine speed Rmax.

[0069] Thus, if motor power engine-performance reduction section 272c outputs desired value and a command value to an engine ECU 240 and the motor main control CPU 262, as for processing, return and the processing same with having mentioned above will be again repeated by step S106.

[0070] Transit which followed an operator's demand by the motor MG 2 since it was not restricted at all by the rotational frequency REV2 of a motor MG 2 when the charge SOC of a dc-battery 194 had exceeded the predetermined value Sre even when abnormalities occur about an engine 150, a motor MG 1, etc. during transit of a hybrid car according to [as explained above] this example, and allowances of enough were in a dc-battery 194 can be performed. Therefore, even after abnormalities occur, it can evacuate smoothly.

[0071] moreover, when the charge SOC of a dc-battery 194 is below the predetermined value Sre and there are no allowances in a dc-battery 194 Since the rotational frequency REV2 of a motor MG 2 is restricted to below the maximum engine speed Rmax and the maximum engine speed Rmax moreover becomes low in connection with Charge SOC decreasing The more Charge SOC decreases, the rotational frequency REV2 of a motor MG 2 is also stopped, and, the more power consumed by the motor MG 2 can be lessened. Consequently, since the rate that Charge SOC decreases to time amount also becomes loose, it becomes possible to lengthen the mileage of that part and a hybrid car.

[0072] Moreover, since it will not fall any more any longer even if Charge SOC decreases if the maximum engine speed Rmax of the set-up motor MG 2 falls and it becomes the predetermined value Rremin, minimum transit of a hybrid car can be guaranteed.

[0073] Now, as explained above, abnormalities occur about an engine 150, a motor MG 1, etc., and when driving a motor MG 2 using the power stored in the dc-battery 194 when there were no allowances in a dc-battery 194, he prepares a limit which was described above to the motor MG 2, and was trying for the charge SOC of a dc-battery 194 to be below the predetermined value Sre, and to stop the power consumed by the motor MG 2 moreover. However, since the power can be charged at a dc-battery 194 and the charge SOC of a dc-battery 194 can be raised when reviving power by the motor MG 2 conversely rather than consuming power by the motor MG 2 even if it is the case where abnormalities occur and there are no allowances in a dc-battery 194 such, it is not necessary to prepare a limit which was described above to the motor MG 2.

[0074] So, when a motor MG 2 performs regeneration actuation, he is trying for the time of a brake etc. not to add a limit to the rotational frequency REV2 of a motor MG 2 at all in this example, even if master control CPU272 is the case where judged with malfunction detection having been carried out in step S102, and it moreover judges with the charge SOC of a dc-battery 194 being below the predetermined value Sre in step S106. Consequently, a motor MG 2 is usually the power engine performance of a passage, since it can perform regeneration actuation, can fully revive power and can charge a dc-battery 194.

[0075] E. modification: -- the range which this invention is not restricted to an above-mentioned example or an above-mentioned operation gestalt, and does not deviate from that summary in addition -- setting -- various voice -- it is possible to set like and to carry out, for example, the following deformation is also possible.

[0076] E-1. Modification 1 : in the above-mentioned example, as shown in drawing 5 , the maximum engine speed Rmax which restricts the engine speed REV2 of a motor MG 2 has fallen in proportion to the charge SOC of a dc-battery 194 decreasing, but there is not necessarily no need of being proportional, and as long as it is in the inclination for maximum engine speed Rmax to fall, at least according to reduction of Charge SOC, you may change how.

[0077] Modification 2 : E-2. When the charge SOC of a dc-battery 194 becomes below the predetermined value Sre in the above-mentioned example, Although the limit is applied by setting up maximum engine speed Rmax, and controlling a motor MG 2 so that the rotational frequency REV2 of a motor MG 2 becomes below the maximum engine speed Rmax It replaces with this, full speed is set up, and you may make it control a motor MG 2 so that the rate of a hybrid car becomes below the full speed.

In this case, the above-mentioned full speed is set up so that it may fall in connection with the charge SOC of a dc-battery 194 decreasing like the case of maximum engine speed R_{max} .

[0078] E-3. Modification 3 : although he is trying to apply a limit to the rotational frequency REV2 of a motor MG 2 in the above-mentioned example when the charge SOC of a dc-battery 194 becomes below the predetermined value S_{re} , this invention is not limited to this, even if it applies a limit to the torque of a motor MG 2, good of it is carried out, and you may make it apply a limit to the output of a motor MG 2.

[0079] For example, what is necessary is to set up the maximum torque, and just to set up the maximum torque so that it may fall according to reduction of Charge SOC while controlling a motor MG 2 so that the torque of a motor MG 2 becomes below the maximum torque when applying a limit to the torque of a motor MG 2.

[0080] Moreover, what is necessary is to set up the maximum output, and just to set up the maximum output similarly, so that it may fall according to reduction of Charge SOC while controlling a motor MG 2 so that the output of a motor MG 2 becomes below the maximum output when applying a limit to the output of a motor MG 2.

[0081] As opposed to the demand output P_{tag} and the demand torque T_{tag} which set up $x\%$ (however, $x < 100$) of rates of a limit, and were demanded by the operator as the other approaches moreover, from a motor MG 2 A motor MG 2 is controlled and you may make it set up the value of the rate x of a limit so that it may fall according to reduction of Charge SOC so that only the demand output P_{tag} , $x\%$ of output of the demand torque T_{tag} , and torque may be outputted.

[0082] E-4. Modification 4 : although the above-mentioned example explained the so-called hybrid car of the machine distribution type which distributes engine power to an axle and the 1st motor MG 1, using a motor MG 1 and planetary AGIA as a power adjusting device This invention can be applied also to the so-called hybrid car of the electric distribution type which distributes engine power electrically as a power adjusting device using the motor MG 1 which is a configuration for Rota, without using planetary AGIA. The motor MG 1 in this case has not the stator fixed to the case other than the inner rotor which is usual Rota but the pivotable outer rotor, and has composition for Rota. In addition, since it is indicated about the hybrid car of such an electric distribution type by JP,9-46965,A indicated by these people, for example, the explanation is omitted here.

[0083] Moreover, this invention is applicable to the hybrid car which, in addition to this, uses as the 1st motor the engine starter generator combined with an engine output shaft, and uses as the 2nd motor the motor for a drive/regeneration combined with an engine output shaft and an engine driving shaft through direct or planetary gear.

[0084] Moreover, although the above-mentioned example explained the hybrid car of the so-called parallel type which distributes mechanically or electrically the power which a generation of electrical energy of the 1st motor takes, and outputs the remaining power to a driving shaft from the power which the engine generated This invention is applicable also to the so-called series type which is not limited to this, generates the power which the engine generated by the 1st motor, drives the 2nd motor with the generated power, and outputs power to a driving shaft of hybrid car.

[0085] Moreover, this invention is applicable to various mobiles, such as an airplane besides a car, and a vessel. That is, this invention is applicable to an engine, the power adjusting device which has the 1st motor, and the mobile equipped with the 2nd motor. Furthermore, this invention can be applied also to the control of those other than a mobile.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the control technique of the 2nd motor at the time of producing abnormalities on an engine or the 1st motor especially about mobiles, such as a hybrid car equipped with an engine, the 1st motor, and the 2nd motor.

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PRIOR ART

[Description of the Prior Art] In recent years, the hybrid car which makes an engine and a motor the source of power is proposed, and it has the so-called parallel hybrid car as a kind of a hybrid car (for example, technique given in JP,9-47094,A etc.). By the parallel hybrid car, when the power outputted from the engine minds the power adjusting device which has the 1st motor, the part is transmitted to a driving shaft and residual power is revived as power by the 1st motor. A dc-battery charges or this power is used for driving the 2nd motor as sources of power other than an engine. Such a hybrid car can output the power outputted from the engine to a driving shaft with the rotational frequency and torque of arbitration by controlling the 1st and 2nd motors in the transfer process of above-mentioned power. It is not concerned with the demand output which should be outputted from a driving shaft, but since an engine can choose the high operation point of operation effectiveness and can be operated, the hybrid car is excellent in saving-resources nature and exhaust air purification nature compared with the conventional car which makes only an engine a driving source.

[Translation done.]

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EFFECT OF THE INVENTION

[The means for solving a technical problem, and its operation and effectiveness] In order to attain a part of above-mentioned purpose [at least], the mobile of this invention The engine which has an output shaft, the driving shaft for outputting power, and the 1st motor combined with said output shaft, Between the 2nd motor combined with said driving shaft, and said 1st and 2nd motors, the rechargeable battery which can exchange power, It is the mobile which equips said engine, said 1st and 2nd motors, and a list with the control unit which can control said rechargeable battery. Said control unit When the abnormalities relevant to said engine or said 1st motor are detected, while controlling to operate only said 2nd motor among said 1st and 2nd motors in said engine and a list When the charge of said rechargeable battery is below a predetermined value after detecting said abnormalities, let it be a summary to control said 2nd motor so that you may reduce the power engine performance of said 2nd motor according to reduction of said charge.

[0007] Moreover, the engine with which the control approach of this invention has an output shaft and the driving shaft for outputting power, The 1st motor combined with said output shaft, and the 2nd motor combined with said driving shaft, Between said 1st and 2nd motors, the rechargeable battery which can exchange power, The process which is the control approach of preparation ***** and detects the abnormalities relevant to the (a) aforementioned engine or said 1st motor, (b) The process controlled to operate only said 2nd motor among said 1st and 2nd motors in said engine and a list when said abnormalities are detected at said process (a), (c) The process which judges whether the charge of said rechargeable battery is below a predetermined value after detecting said abnormalities at said process (a), (d) When you judge with said charge being below a predetermined value at said process (c), let it be a summary to have the process which controls said 2nd motor so that you may reduce the power engine performance of said 2nd motor according to reduction of said charge.

[0008] When abnormalities arise in relation to an engine or the 1st motor, a mobile cannot be moved by making an engine into the source of power. So, when the abnormalities relevant to an engine or the 1st motor are detected, only the 2nd motor is controlled by the mobile or the control approach of this invention to operate. Moreover, when abnormalities arise in relation to an engine or the 1st motor, power can be revived by the 1st motor and a rechargeable battery cannot be made to charge. So, when the charge of a rechargeable battery is below a predetermined value after detecting abnormalities, the 2nd motor is controlled by the mobile or the control approach of this invention to reduce the power engine performance of the 2nd motor according to reduction in a charge.

[0009] Therefore, since the power engine performance of the 2nd motor is reduced according to reduction in a charge even when according to the mobile or the control approach of this invention the abnormalities relevant to an engine or the 1st motor occur and the charge of a rechargeable battery is decreasing, power consumed by the part and the 2nd motor can be lessened. Since the rate that the charge of a rechargeable battery decreases also becomes loose by this, the migration length of the part and a mobile is extended and the thing of it can be carried out.

[0010] In the mobile of this invention, as power engine performance of said 2nd motor, as for said control unit, it is desirable to control said 2nd motor so that at least one of the maximum output of said

2nd motor, the maximum engine speed of said 2nd motor, and the maximum torque of said 2nd motor may be reduced.

[0011] Thus, as power engine performance of the 2nd motor, the power consumed by the 2nd motor can be stopped by controlling the 2nd motor so that at least one of the maximum output of the 2nd motor, the maximum engine speed of said 2nd motor, and the maximum torque of said 2nd motor may be reduced.

[0012] In the mobile of this invention, as for said control unit, it is desirable to control said 2nd motor so that the power engine performance of said 2nd motor may not be reduced, until the charge of said rechargeable battery becomes said below predetermined value, after detecting said abnormalities.

[0013] Thus, when the abnormalities which compared the mobile and were described above during migration by constituting occur and the charge of a rechargeable battery exceeds the above-mentioned predetermined value, since the power engine performance of the 2nd motor is not reduced, it becomes movable as a demand of an operator succeedingly, and urgent evasion can be performed smoothly.

[0014] In the mobile of this invention, after said control unit reduces the power engine performance of said 2nd motor to predetermined extent, it is desirable for it not to be concerned with reduction of said charge and not to reduce the power engine performance of said 2nd motor any more.

[0015] Thus, by constituting, reducing the power engine performance of the 2nd motor beyond the need is lost, and it becomes possible to guarantee minimum migration of a mobile.

[0016] In the mobile of this invention, when said 2nd motor performs regeneration actuation even if it is the case where the charge of said rechargeable battery is said below predetermined value after detecting said abnormalities, as for said control unit, it is desirable to control said 2nd motor so that the power engine performance of said 2nd motor may not be reduced.

[0017] thus, when the abnormalities relevant to an engine or the 1st motor occur, the charge of a rechargeable battery is decreasing and the 2nd motor performs regeneration actuation Since the 2nd motor can usually perform regeneration actuation by the power engine performance of a passage by making it not reduce the power engine performance of the 2nd motor, power can fully be revived, the revived power can be charged at a rechargeable battery, and the charge of a rechargeable battery can be raised.

[0018]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained in order of the following based on an example.

A. motor transit [at the time of the configuration D. malfunction detection of the basic actuation C. control system of the whole hybrid car configuration B. hybrid car]: -- configuration [of a D-1. control unit]: -- motor transit control processing [at the time of D-2. malfunction detection]: -- E. modification E-1. modification 1:E-2. modification 2: -- E-3. modification 3:E-4. modification 4: [0019] A. The whole hybrid car configuration : drawing 1 is the explanatory view showing the whole hybrid car configuration containing the shift control device as one example of this invention. This hybrid car is equipped with an engine 150, the two a motor/generators MG1 and MG2, and three prime movers of **. Here, "the motor/generator" means the prime mover which functions also as a motor and functions also as a generator. In addition, below, since it is easy, these are only called a "motor." Control of a car is performed by the control system 200.

[0020] The control system 200 has Main ECU 210, the brake ECU 220, the dc-battery ECU 230, and the engine ECU 240. Each ECU is constituted as one unit by which two or more circuit elements, such as a microcomputer, and an input interface, an output interface, have been arranged on the one circuit board. Main ECU 210 has the motor control section 260 and the master control section 270. The master control section 270 has the function to determine controlled variables, such as allocation of three prime movers 150 and the output of MG1 and MG2.

[0021] The power system 300 has an engine 150, motors MG1 and MG2, the drive circuit 191,192, the system main relay 193, and a dc-battery 194.

[0022] An engine 150 is the usual gasoline engine and rotates a crankshaft 156. Operation of an engine 150 is controlled by the engine ECU 240. An engine ECU 240 performs control of the fuel oil

consumption and others of an engine 150 according to the command from the master control section 270.

[0023] Motors MG1 and MG2 are constituted as a synchronous motor, and are equipped with Rota 132,142 which has two or more permanent magnets in a peripheral face, and the stator 133,143 around which the three phase coil 131,141 which forms rotating magnetic field was wound. The stator 133,143 is being fixed to the case 119. The three phase coil 131,141 wound around the stator 133,143 of motors MG1 and MG2 is connected to the dc-battery 194 through the system main relay 193 through the drive circuit 191,192, respectively. The system main relay 193 is a relay switch which performs connection or separation with a dc-battery 194 and the drive circuit 191,192. The system main relay 193 is controlled by the master control section 270. Moreover, the power from a dc-battery 194 is supplied also to auxiliary machinery (not shown) through the system main relay 193.

[0024] The drive circuit 191,192 is the transistor inverter which it equipped with one pair of transistor as a switching element at a time for every phase. The drive circuit 191,192 is controlled by the motor control section 260. If the transistor of the drive circuit 191,192 is switched by the control signal from the motor control section 260, a current will flow between a dc-battery 194 and motors MG1 and MG2. Motors MG1 and MG2 can also operate as a motor which carries out a rotation drive in response to supply of the power from a dc-battery 194, when Rota 132,142 is rotating according to external force (this operating state is hereafter called power running), can function as a generator which makes the both ends of the three phase coil 131,141 produce electromotive force, and can also charge a dc-battery 194 (this operating state is hereafter called regeneration).

[0025] The revolving shaft of an engine 150 and motors MG1 and MG2 is mechanically combined through planetary gear 120. the planetary carrier 124 with which planetary gear 120 have a sun gear 121, a ring wheel 122, and the planetary pinion gear 123 -- since -- it is constituted. By the hybrid car of this example, the crankshaft 156 of an engine 150 is combined with the planetary carrier shaft 127 through the damper 130. The damper 130 is formed in order to absorb twist vibration produced in a crankshaft 156. Rota 132 of a motor MG 1 is combined with the sun gear shaft 125. Rota 142 of a motor MG 2 is combined with the ring wheel shaft 126. Rotation of a ring wheel 122 is transmitted to an axle 112 and Wheels 116R and 116L through a chain belt 129 and a differential gear 114.

[0026] Various sensors are used for the control system 200 in order to realize control of the whole car. For example The amount of treading in of the accelerator by the operator The accelerator sensor 165 for detecting, the location of a shift lever A (shift position) The dc-battery sensor 196 for detecting the brake sensor 163 for detecting the shift position sensor 167 and the treading-in pressure of a brake to detect and the charge condition of a dc-battery 194 and the rotational frequency of a motor MG 2 are used for the rotational frequency sensor 144 of a measurement sake etc. Since it is mechanically combined with the chain belt 129, the ratio of the rotational frequency of the ring wheel shaft 126 and an axle 112 of the ring wheel shaft 126 and an axle 112 is fixed. Therefore, not only the rotational frequency of a motor MG 2 but the rotational frequency of an axle 112 is detectable by the rotational frequency sensor 144 formed in the ring wheel shaft 126. Moreover, although it is not a sensor, the ignition switch 161 for performing starting/halt of the power system 300 etc. is used by turning an ignition key 162.

[0027] B. Fundamental actuation of a hybrid car : in order to explain fundamental actuation of a hybrid car, below, explain actuation of planetary gear 120 first. Planetary gear 120 have the property in which the rotational frequency of the remaining revolving shaft is decided, if the rotational frequency of two of three revolving shafts mentioned above is determined. The relation of the rotational frequency of each revolving shaft is as a degree type (1).

[0028]

$$N_c = N_s \rho / (1 + \rho) + N_r / (1 + \rho) \quad (1)$$

[0029] Here, N_c is [the rotational frequency of the sun gear shaft 125 and N_r of the rotational frequency of the planetary carrier shaft 127 and N_s] the rotational frequencies of the ring wheel shaft 126. Moreover, ρ is the gear ratio of a sun gear 121 and a ring wheel 122 as it is expressed with a degree type.

[0030] $\rho = [\text{number of teeth of sun gear 121}] / [\text{the number of teeth of a ring wheel 122}]$

[0031] Moreover, the torque of three revolving shafts is not concerned with a rotational frequency, but has the fixed relation given by the degree type (2) and (3).

[0032]

$$T_s = T_c \rho / (1 + \rho) \quad \text{-- (2)}$$

$$T_r = T_c \cdot 1 / (1 + \rho) = T_s / \rho \quad \text{-- (3)}$$

[0033] Here, T_c is [the torque of the sun gear shaft 125 and T_r of the torque of the planetary carrier shaft 127 and T_s] the torque of the ring wheel shaft 126.

[0034] The hybrid car of this example can run in the various condition by the function of such planetary gear 120. For example, where [comparatively low speed] transit is begun, while the hybrid car had suspended the engine 150, it transmits and runs power to an axle 112 by acting as the power running of the motor MG 2. It may run carrying out idle operation of the engine 150 similarly.

[0035] If a hybrid car reaches a predetermined rate after transit initiation, by the torque outputted by acting as the power running of the motor MG 1, a control system 200 will carry out motoring of the engine 150, and will start. At this time, the reaction force torque of a motor MG 1 is outputted also to a ring wheel 122 through planetary gear 120.

[0036] If an engine 150 is operated and the planetary carrier shaft 127 is rotated, the sun gear shaft 125 and the ring wheel shaft 126 will rotate under the conditions with which are satisfied of upper type (1) - (3). The power by rotation of the ring wheel shaft 126 is transmitted to Wheels 116R and 116L as it is. The power by rotation of the sun gear shaft 125 can be revived as power by the 1st motor MG 1. On the other hand, if it acts as the power running of the 2nd motor MG 2, power can be outputted to Wheels 116R and 116L through the ring wheel shaft 126.

[0037] At the time of steady operation, the output of an engine 150 is set as a value almost equal to the demand power (namely, rotational frequency x torque of an axle 112) of an axle 112. At this time, a part of output of an engine 150 is told to the direct axle 112 through the ring wheel shaft 126, and the remaining output is revived as power by the 1st motor MG 1. Since the 2nd motor MG 2 generates the torque which rotates the ring wheel shaft 126, the revived power is used. Consequently, it is possible to drive an axle 112 with desired torque with a desired rotational frequency.

[0038] When the torque transmitted to an axle 112 runs short, torque is assisted by the 2nd motor MG 2. The power stored in the power and the dc-battery 149 which were revived by the 1st motor MG 1 is used for the power for this assistance. Thus, a control system 200 controls operation of two motors MG1 and MG2 according to the demand power which should be outputted from an axle 112.

[0039] The hybrid car of this example can also be gone astern, with the engine 150 operated. Operation of an engine 150 rotates the planetary carrier shaft 127 in the time of advance, and this direction. If the 1st motor MG 1 is controlled and the sun gear shaft 125 is rotated at a rotational frequency higher than the rotational frequency of the planetary carrier shaft 127 at this time, the ring wheel shaft 126 will be reversed in the go-astern direction a passage clear from an upper type (1). A control system 200 rotating the 2nd motor MG 2 in the go-astern direction, it can control the output torque and can reverse a hybrid car.

[0040] Planetary gear 120 are in the condition which the ring wheel 122 stopped, and can rotate the planetary carrier 124 and a sun gear 121. Therefore, an engine 150 can be operated also after the car has stopped. For example, if the charge of a dc-battery 194 decreases, a dc-battery 194 can be charged by operating an engine 150 and carrying out regeneration operation of the 1st motor MG 1. If it acts as the power running of the 1st motor MG 1 when the car has stopped, by the torque, motoring of the engine 150 can be carried out and it can start.

[0041] C. The configuration of a control system : drawing 2 is the block diagram showing the more detailed configuration of the control system 200 in an example. The master control section 270 includes master control CPU272 and the power control circuit 274. Moreover, the motor control section 260 has two motor control CPUs264,266 for controlling the motor main control CPU 262 and two motors MG1 and MG2, respectively. Each CPU is equipped with CPU, ROM and RAM, the input port, and the output port which are not illustrated, respectively, and constitutes 1 chip microcomputer with these.

[0042] Master control CPU272 controls starting of the power system 300, or determines controlled

variables, such as three prime movers 150, a rotational frequency of MG1 and MG2, and allocation of torque, supplies various kinds of desired value to other CPUs and ECUs, and has the function which controls the drive of each prime mover. For this control, while the shift position signal SP 1 which shows the accelerator position signal AP which shows the ignition switch signal IG and accelerator opening, and a shift position, and SP2 grade are supplied, to system main relay 193 grade, a seizing signal ST is outputted to master control CPU272. In addition, the shift position sensor 167, the accelerator sensor 165, etc. are duplex-sized if needed.

[0043] The power control circuit 274 is a DC-DC converter for changing the high voltage direct current electrical potential difference of a dc-battery 194 into the low voltage direct current voltage for each circuits in Main ECU 210. This power control circuit 274 also has the function as a supervisory circuit which supervises the abnormalities of master control CPU272.

[0044] An engine ECU 240 is the engine output request value PReq given from master control CPU272. It responds and an engine 150 is controlled. From an engine ECU 240, the engine speed REVen of an engine 150 is fed back to master control CPU272.

[0045] The motor main control CPU 262 supplies current desired value I1req and I2req to two motor control CPUs264,266 according to torque desired value T1req about the motors MG1 and MG2 given from master control CPU272, and T2req, respectively. Motor control CPU264,266 controls the drive circuit 191,192 according to current desired value I1req and I2req, respectively, and drives motors MG1 and MG2. From the rotational frequency sensor of motors MG1 and MG2, the rotational frequencies REV1 and REV2 of motors MG1 and MG2 are fed back to the motor main control CPU 262. In addition, the engine speeds REV1 and REV2 of motors MG1 and MG2, the current value IB from the dc-battery 194 to the drive circuit 191,192, etc. are fed back to master control CPU272 from the motor main control CPU 262.

[0046] A dc-battery ECU 230 supervises the charge SOC of a dc-battery 194, and supplies it to master control CPU272. Master control CPU272 opts for the output of each prime mover in consideration of this charge SOC. That is, when charge is required, larger power than an output required for transit is made to output to an engine 150, and the part is distributed to the charge actuation by the 1st motor MG 1.

[0047] A brake ECU 220 performs control which balances the hydraulic brake which is not illustrated and the regenerative brake by the 2nd motor MG 2. This reason is that regeneration actuation by the 2nd motor MG 2 is performed, and a dc-battery 194 is charged by this hybrid car at the time of a brake. A brake ECU 220 is based on the brake pressure force BP from the brake sensor 163, and, specifically, is the regeneration desired value REGreq to master control CPU272. It inputs. Master control CPU272 is this desired value REGreq. It is based, opts for actuation of motors MG1 and MG2, and the regeneration effective value REGprac is fed back to a brake ECU 220. A brake ECU 220 is this regeneration effective value REGprac and the regeneration desired value REGreq. Based on difference and the brake pressure force BP, the amount of brakes by the hydraulic brake is controlled to a suitable value.

[0048] As mentioned above, master control CPU272 opts for each prime mover 150 and the output of MG1 and MG2, and supplies desired value to ECU240 and CPU264,266 which take charge of each control. ECU240 and CPU264,266 control desired value ***** each of this prime mover. Consequently, a hybrid car can output and run suitable power from an axle 112 according to a run state. Moreover, at the time of a brake, a brake ECU 220 and master control CPU272 cooperate, and actuation of each prime mover or a hydraulic brake is controlled. Consequently, braking for which an operator is not made to sense sense of incongruity not much is realizable, reviving power.

[0049] Four CPUs272,262,264,266 supervise mutual abnormalities using the so-called watch locking-dog pulse WDP, and when abnormalities occur in CPU and a watch locking-dog pulse stops, they have the function to make the CPU supply and reset reset-signal RES. In addition, the abnormalities of master control CPU272 are supervised by the power control circuit 274.

[0050] The hysteresis of the abnormal occurrence of the accelerator sensor 165 or the shift position sensor 167 is registered into the abnormality hysteresis registration circuit 280. Moreover, the reset signals RES1 and RES2 transmitted and received between master control CPU272 and the motor main

control CPU 262 are inputted into the input port of the abnormality hysteresis registration circuit 280. The abnormality hysteresis registration circuit 280 stores this in internal memory, if these reset signals RES1 and RES2 occur.

[0051] In addition, master control CPU272 and the abnormality hysteresis registration circuit 280 can perform various kinds of demands and notices mutually through the two-way communication wiring 214. Moreover, the two-way communication wiring 212 is formed also between master control CPU272 and the motor main control CPU 262.

[0052] D. motor transit [at the time of malfunction detection]: -- configuration [of a D-1. control unit]: -- drawing 3 is the block diagram showing the configuration of the control unit for controlling the motor transit at the time of malfunction detection. Master control CPU272 has the function as malfunction detection judging section 272a, the function as charge judging section 272b, and the function as motor power engine-performance reduction section 272c. Malfunction detection judging section 272a judges whether malfunction detection was carried out in relation to the engine 150 or the motor MG 1 based on the signal outputted from an engine ECU 240 or the motor main control CPU 262. Charge judging section 272b judges whether the charge SOC of a dc-battery 194 became below a predetermined value based on the signal outputted from the dc-battery ECU 230. When abnormalities are detected and Charge SOC becomes below a predetermined value, motor power engine-performance reduction section 272c takes out directions of motor control to the motor main control CPU 262 so that the power engine performance of the 2nd motor may be reduced.

[0053] D-2. Motor transit control processing at the time of malfunction detection : drawing 4 is a flow chart which shows the procedure of the motor transit control processing at the time of the malfunction detection by the control device shown in drawing 3 . When the processing shown in drawing 4 is started, malfunction detection judging section 272a of master control CPU272 Input the signal outputted from an engine ECU 240, and the signal outputted from the motor main control CPU 262, and it carries out based on these signals. [whether malfunction detection was carried out about the part (for example, the engine ECU 240) relevant to engine 150 the very thing or it, and] Or it judges whether malfunction detection was carried out about the parts (for example, the drive circuit 191, 1st motor control CPU264, etc.) relevant to motor MG1 the very thing or it (step S102). And when it judges with malfunction detection being carried out about neither, by the usual processing, master control CPU272 computes torque desired value T1req about the engine output request value PReq and motors MG1 and MG2, and T2req, and gives them to an engine ECU 240 and the motor main control CPU 262. On the other hand, when it judges with malfunction detection having been carried out about either, master control CPU272 performs processing at the time of malfunction detection which is mentioned later.

[0054] When abnormalities occur on an engine 150, a motor MG 1, etc., the following faults arise by the hybrid car. That is, if abnormalities occur into an engine 150 or the part relevant to it, since an engine 150 will carry out a urinal stall, by the hybrid car, the transit which made the engine 150 the source of power will be impossible.

[0055] Moreover, since on-off operation of the engine 150 is carried out, even if it is under transit, an engine 150 may stop, but also when abnormalities occur into a motor MG 1 or the part relevant to it during such an engine shutdown, the transit which made the engine 150 the source of power will become impossible by the hybrid car.

[0056] It is because it becomes impossible [the dc-battery loess transit by reverse ***** which used the engine 150 since it became impossible to put an engine 150 into operation by motoring already according to a motor MG 1 if abnormalities occur during an engine shutdown at motor MG1 grade, although the dc-battery loess transit by reverse ***** if the engine is operating even if abnormalities arise in motor MG1 grade by the hybrid car is possible].

[0057] Since it also becomes impossible to revive power by the motor MG 1, it will also become impossible moreover, to charge power by the hybrid car at a dc-battery 194, if abnormalities occur on an engine 150, a motor MG 1, etc.

[0058] Then, in order to cope with such fault, when it judges with malfunction detection having been carried out in step S102, as for master control CPU272, based on the signal with which charge judging

section 272b was outputted from the dc-battery ECU 230, the charge SOC of a dc-battery 194 judges first whether it became below the predetermined value S_{re} (step S106). Without preparing a limit in any way, since there are sufficient allowances for a dc-battery 194 if the charge SOC of a dc-battery 194 has exceeded the predetermined value S_{re} , a motor MG 2 is driven using the power stored in the dc-battery 194, and it is made to perform motor transit by the motor MG 2.

[0059] Motor power engine-performance reduction section 272c computes the demand output P_{tag} demanded by the operator based on the accelerator position signal AP outputted from the accelerator sensor 165, and, specifically, computes the computed demand output P_{tag} to the value of the rotational frequency REV2 of the motor MG 2 outputted from the motor main control CPU 262, and the demand torque T_{tag} further (step S108). Since the rotational frequency REV2 of a motor MG 2 is proportional to the rotational frequency of an axle 112, as a result the vehicle speed, it can compute the demand torque T_{tag} demanded by the operator as a quotient of the demand output P_{tag} and the present rotational frequency REV2.

[0060] Next, while motor power engine-performance reduction section 272c outputs $P_{req}=0$ as an engine output request value to an engine ECU 240, to the motor main control CPU 262, as a torque command value about a motor MG 1, it outputs $T1_{req}=0$ and outputs $T2_{req}=T_{tag}$ as a torque command value about a motor MG 2.

[0061] Thereby, both the engine 150 and the motor MG 1 will be in a idle state, and they are controlled so that a motor MG 2 outputs Torque T_{tag} . Consequently, by the motor MG 2, motor transit will be carried out and, moreover, a hybrid car can take out the output as a demand of an operator.

[0062] On the other hand, in step S106, since there are no allowances in a dc-battery 194 so much when the charge SOC of a dc-battery 194 is below the predetermined value S_{re} , after stopping the power consumed by the motor MG 2, it is made to prepare a limit which is mentioned later, and to perform motor transit by the motor MG 2.

[0063] It asks for the maximum engine speed R_{max} of a motor MG 2 from the map on which motor power engine-performance reduction section 272c was specifically beforehand prepared based on the charge SOC of the dc-battery 194 obtained from charge judging section 272b (step S112).

[0064] An example of the map which expresses the relation between the charge SOC of such a dc-battery 194 and the maximum engine speed R_{max} of a motor MG 2 to drawing 5 is shown. In drawing 5, an axis of abscissa is the charge SOC of a dc-battery 194, and an axis of ordinate is the maximum engine speed R_{max} of a motor MG 2. As shown in drawing 5, when the charge SOC of a dc-battery 194 has exceeded the predetermined value S_{re} , the rotational frequency REV2 of a motor MG 2 is not restricted at all, but as for the case below the predetermined value S_{re} , maximum engine speed R_{max} is set up, and the rotational frequency REV2 of a motor MG 2 is restricted to below the maximum engine speed R_{max} so that it may mention later. And the maximum engine speed R_{max} is set up so that it may fall in proportion to the charge SOC of a dc-battery 194 decreasing. And finally, if the maximum engine speed R_{max} becomes the predetermined value R_{remin} , even if Charge SOC decreases, it will not fall any more any longer.

[0065] In this way, from a map as shown in drawing 5, if it asks for the maximum engine speed R_{max} of a motor MG 2 next, motor power engine-performance reduction section 272c will judge whether the value of the rotational frequency REV2 of the motor MG 2 outputted from the motor main control CPU 262 has exceeded the maximum engine speed R_{max} for which it asked (step S114). Since it is in a limit when the value of the rotational frequency REV2 of a motor MG 2 is below the maximum engine speed R_{max} as a result of a judgment, it is satisfactory even if it takes out the output as a demand of an operator. Therefore, motor power engine-performance reduction section 272c processes steps S108 and S110 mentioned above, and performs motor transit with the output according to a demand of an operator.

[0066] However, when the value of the rotational frequency REV2 of a motor MG 2 has exceeded maximum engine speed R_{max} as a result of the judgment, a motor MG 2 is controlled to come in a limit. Specifically, motor power engine-performance reduction section 272c computes target torque $T2_{tag}$ of the motor MG 2 by which the value of the rotational frequency REV2 of a motor MG 2 becomes equal

to maximum engine speed R_{max} first (step S116). For example, target torque $T2_{tag}$ of a motor MG 2 is computed according to the proportional integral used in proportional-plus-integral control (PI control). That is, target torque $T2_{tag}$ of a motor MG 2 is calculated from the sum of the proportional obtained multiplying the value of a rotational frequency $REV2$, and deflection with maximum engine speed R_{max} by the predetermined proportionality constant, the integral term acquired multiplying the time quadrature value of the above-mentioned deflection by the predetermined proportionality constant, and **.

[0067] Next, while motor power engine-performance reduction section 272c outputs $PE_{req}=0$ as an engine output request value to an engine ECU 240, to the motor main control CPU 262, as a torque command value about a motor MG 1, it outputs $T1_{req}=0$ and outputs $T2_{req}=T2_{tag}$ as a torque command value about a motor MG 2.

[0068] Thereby, both the engine 150 and the motor MG 1 will be in a idle state, and are controlled to output torque $T2_{tag}$ whose motor MG 2 is target torque. Consequently, since the value of the rotational frequency $REV2$ of the motor MG 2 on which motor transit was carried out and the hybrid car had moreover exceeded maximum engine speed R_{max} by the motor MG 2 is controlled to approach that maximum engine speed R_{max} , though the operator is demanding the output beyond it, finally the value of the rotational frequency $REV2$ of a motor MG 2 is restricted to below the maximum engine speed R_{max} .

[0069] Thus, if motor power engine-performance reduction section 272c outputs desired value and a command value to an engine ECU 240 and the motor main control CPU 262, as for processing, return and the processing same with having mentioned above will be again repeated by step S106.

[0070] Transit which followed an operator's demand by the motor MG 2 since it was not restricted at all by the rotational frequency $REV2$ of a motor MG 2 when the charge SOC of a dc-battery 194 had exceeded the predetermined value S_{re} even when abnormalities occur about an engine 150, a motor MG 1, etc. during transit of a hybrid car according to [as explained above] this example, and allowances of enough were in a dc-battery 194 can be performed. Therefore, even after abnormalities occur, it can evacuate smoothly.

[0071] moreover, when the charge SOC of a dc-battery 194 is below the predetermined value S_{re} and there are no allowances in a dc-battery 194 Since the rotational frequency $REV2$ of a motor MG 2 is restricted to below the maximum engine speed R_{max} and the maximum engine speed R_{max} moreover becomes low in connection with Charge SOC decreasing The more Charge SOC decreases, the rotational frequency $REV2$ of a motor MG 2 is also stopped, and, the more power consumed by the motor MG 2 can be lessened. Consequently, since the rate that Charge SOC decreases to time amount also becomes loose, it becomes possible to lengthen the mileage of that part and a hybrid car.

[0072] Moreover, since it will not fall any more any longer even if Charge SOC decreases if the maximum engine speed R_{max} of the set-up motor MG 2 falls and it becomes the predetermined value R_{remin} , minimum transit of a hybrid car can be guaranteed.

[0073] Now, as explained above, abnormalities occur about an engine 150, a motor MG 1, etc., and when driving a motor MG 2 using the power stored in the dc-battery 194 when there were no allowances in a dc-battery 194, he prepares a limit which was described above to the motor MG 2, and was trying for the charge SOC of a dc-battery 194 to be below the predetermined value S_{re} , and to stop the power consumed by the motor MG 2 moreover. However, since the power can be charged at a dc-battery 194 and the charge SOC of a dc-battery 194 can be raised when reviving power by the motor MG 2 conversely rather than consuming power by the motor MG 2 even if it is the case where abnormalities occur and there are no allowances in a dc-battery 194 such, it is not necessary to prepare a limit which was described above to the motor MG 2.

[0074] So, when a motor MG 2 performs regeneration actuation, he is trying for the time of a brake etc. not to add a limit to the rotational frequency $REV2$ of a motor MG 2 at all in this example, even if master control CPU272 is the case where judged with malfunction detection having been carried out in step S102, and it moreover judges with the charge SOC of a dc-battery 194 being below the predetermined value S_{re} in step S106. Consequently, a motor MG 2 is usually the power engine

performance of a passage, since it can perform regeneration actuation, can fully revive power and can charge a dc-battery 194.

[0075] E. modification: -- the range which this invention is not restricted to an above-mentioned example or an above-mentioned operation gestalt, and does not deviate from that summary in addition -- setting -- various voice -- it is possible to set like and to carry out, for example, the following deformation is also possible.

[0076] E-1. Modification 1 : in the above-mentioned example, as shown in drawing 5 , the maximum engine speed R_{max} which restricts the engine speed REV2 of a motor MG 2 has fallen in proportion to the charge SOC of a dc-battery 194 decreasing, but there is not necessarily no need of being proportional, and as long as it is in the inclination for maximum engine speed R_{max} to fall, at least according to reduction of Charge SOC, you may change how.

[0077] Modification 2 : E-2. When the charge SOC of a dc-battery 194 becomes below the predetermined value S_{re} in the above-mentioned example, Although the limit is applied by setting up maximum engine speed R_{max} , and controlling a motor MG 2 so that the rotational frequency REV2 of a motor MG 2 becomes below the maximum engine speed R_{max} It replaces with this, full speed is set up, and you may make it control a motor MG 2 so that the rate of a hybrid car becomes below the full speed. In this case, the above-mentioned full speed is set up so that it may fall in connection with the charge SOC of a dc-battery 194 decreasing like the case of maximum engine speed R_{max} .

[0078] E-3. Modification 3 : although he is trying to apply a limit to the rotational frequency REV2 of a motor MG 2 in the above-mentioned example when the charge SOC of a dc-battery 194 becomes below the predetermined value S_{re} , this invention is not limited to this, even if it applies a limit to the torque of a motor MG 2, good of it is carried out, and you may make it apply a limit to the output of a motor MG 2.

[0079] For example, what is necessary is to set up the maximum torque, and just to set up the maximum torque so that it may fall according to reduction of Charge SOC while controlling a motor MG 2 so that the torque of a motor MG 2 becomes below the maximum torque when applying a limit to the torque of a motor MG 2.

[0080] Moreover, what is necessary is to set up the maximum output, and just to set up the maximum output similarly, so that it may fall according to reduction of Charge SOC while controlling a motor MG 2 so that the output of a motor MG 2 becomes below the maximum output when applying a limit to the output of a motor MG 2.

[0081] As opposed to the demand output P_{tag} and the demand torque T_{tag} which set up $x\%$ (however, $x < 100$) of rates of a limit, and were demanded by the operator as the other approaches moreover, from a motor MG 2 A motor MG 2 is controlled and you may make it set up the value of the rate x of a limit so that it may fall according to reduction of Charge SOC so that only the demand output P_{tag} , $x\%$ of output of the demand torque T_{tag} , and torque may be outputted.

[0082] E-4. Modification 4 : although the above-mentioned example explained the so-called hybrid car of the machine distribution type which distributes engine power to an axle and the 1st motor MG 1, using a motor MG 1 and planetary AGIA as a power adjusting device This invention can be applied also to the so-called hybrid car of the electric distribution type which distributes engine power electrically as a power adjusting device using the motor MG 1 which is a configuration for Rota, without using planetary AGIA. The motor MG 1 in this case has not the stator fixed to the case other than the inner rotor which is usual Rota but the pivotable outer rotor, and has composition for Rota. In addition, since it is indicated about the hybrid car of such an electric distribution type by JP,9-46965,A indicated by these people, for example, the explanation is omitted here.

[0083] Moreover, this invention is applicable to the hybrid car which, in addition to this, uses as the 1st motor the engine starter generator combined with an engine output shaft, and uses as the 2nd motor the motor for a drive/regeneration combined with an engine output shaft and an engine driving shaft through direct or planetary gear.

[0084] Moreover, although the above-mentioned example explained the hybrid car of the so-called parallel type which distributes mechanically or electrically the power which a generation of electrical

energy of the 1st motor takes, and outputs the remaining power to a driving shaft from the power which the engine generated This invention is applicable also to the so-called series type which is not limited to this, generates the power which the engine generated by the 1st motor, drives the 2nd motor with the generated power, and outputs power to a driving shaft of hybrid car.

[0085] Moreover, this invention is applicable to various mobiles, such as an airplane besides a car, and a vessel. That is, this invention is applicable to an engine, the power adjusting device which has the 1st motor, and the mobile equipped with the 2nd motor. Furthermore, this invention can be applied also to the control of those other than a mobile.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In such a hybrid car, when abnormalities arise on an engine, the 1st motor, etc. which were mentioned above, it becomes impossible to make it run a car by making an engine 150 into the source of power so that it may mention later. Since it also becomes impossible to revive power by the 1st motor, it also becomes impossible moreover, to charge power at a dc-battery. If the charge of a dc-battery decreases in a such case, how it is made to run a hybrid car, extending mileage will pose a problem.

[0004] In addition, as a thing relevant to this kind of technique, the thing of a publication mentions to JP,10-248104,A and it is *****, for example. When the charge of a dc-battery decreases in the electric vehicle which makes only a motor the source of power in this proposed example and transit almost becomes impossible, it is made movable [short distance] so that it may not become an obstacle of other cars, a pedestrian, etc.

[0005] The purpose of this invention is to offer the mobile which can extend migration length, and its control approach, when the trouble of the above-mentioned conventional technique is solved, abnormalities occur on an engine, the 1st motor, etc. and the charge of a rechargeable battery is decreasing.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the explanatory view showing the whole hybrid car configuration containing the shift control device as one example of this invention.

[Drawing 2] It is the block diagram showing the more detailed configuration of the control system 200 of drawing 1 .

[Drawing 3] It is the block diagram showing the configuration of the control device for controlling the motor transit at the time of malfunction detection.

[Drawing 4] It is the flow chart which shows the procedure of the motor transit control processing at the time of the malfunction detection by the control device shown in drawing 3 .

[Drawing 5] It is the explanatory view showing an example of the map showing the relation between the charge SOC of a dc-battery 194, and the maximum engine speed Rmax of a motor MG 2.

[Description of Notations]

- 112 -- Axle
- 114 -- Differential gear
- 116R, 116L -- Wheel
- 119 -- Case
- 120 -- Planetary gear
- 121 -- Sun gear
- 122 -- Ring wheel
- 123 -- Planetary pinion gear
- 124 -- Planetary carrier
- 125 -- Sun gear shaft
- 126 -- Ring wheel shaft
- 127 -- Planetary carrier shaft
- 129 -- Chain belt
- 130 -- Damper
- 131,141 -- Three phase coil
- 132,142 -- Rota
- 133,143 -- Stator
- 144 -- Rotational frequency sensor
- 149 -- Dc-battery
- 150 -- Engine
- 156 -- Crankshaft
- 161 -- Ignition switch
- 162 -- Ignition key
- 163 -- Brake sensor
- 165 -- Accelerator sensor
- 167 -- Shift position sensor

191,192 -- Drive circuit
193 -- System main relay
194 -- Dc-battery
196 -- Dc-battery sensor
200 -- Control system
210 -- Main ECU
212 -- Two-way communication wiring
214 -- Two-way communication wiring
220 -- Brake ECU
230 -- Dc-battery ECU
240 -- Engine ECU
260 -- Motor control section
262 -- Motor main control CPU
264,266 -- Motor control CPU
270 -- Master control section
272 -- Master control CPU
272a -- Malfunction detection judging section
272b -- Charge judging section
272c -- Motor power engine-performance reduction section
274 -- Power control circuit
280 -- Abnormality hysteresis registration circuit
300 -- Power system

[Translation done.]

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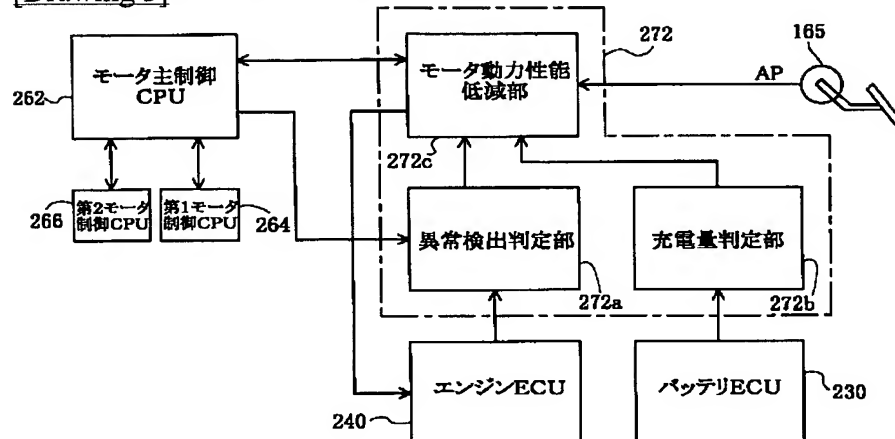
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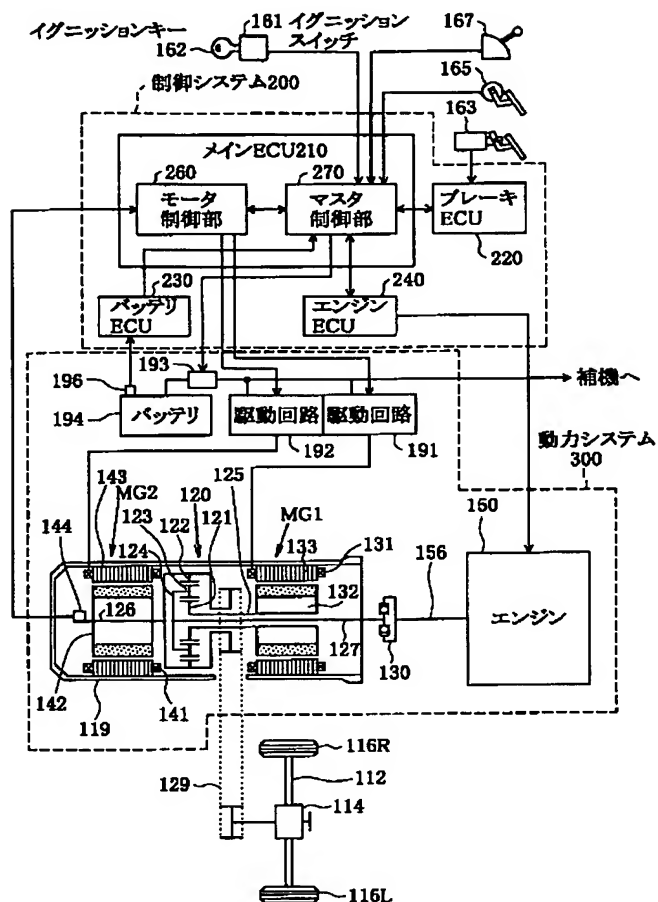
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DRAWINGS

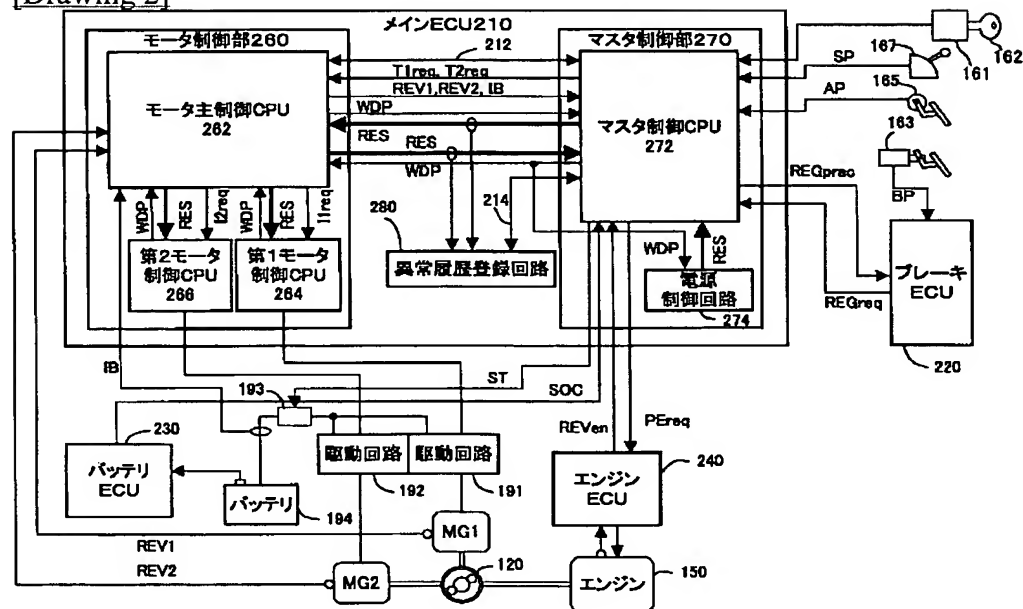
[Drawing 3]



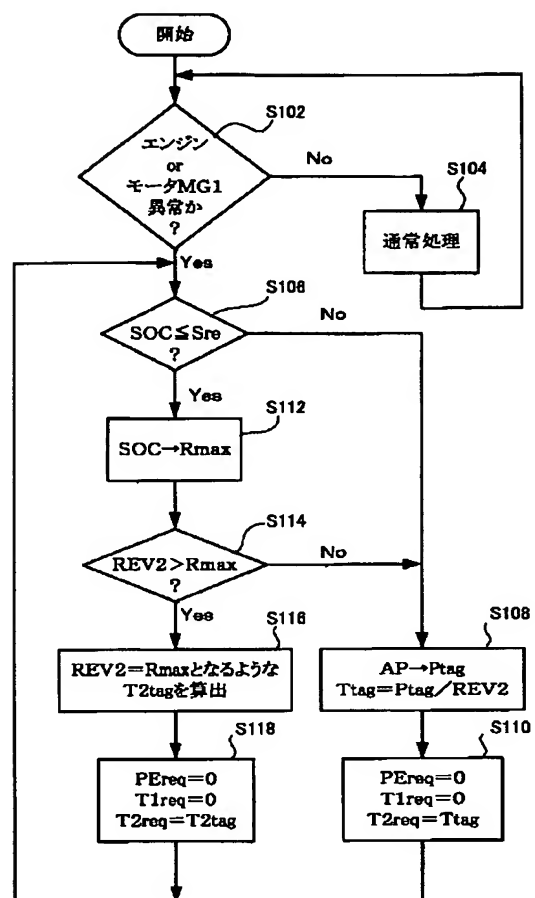
[Drawing 1]



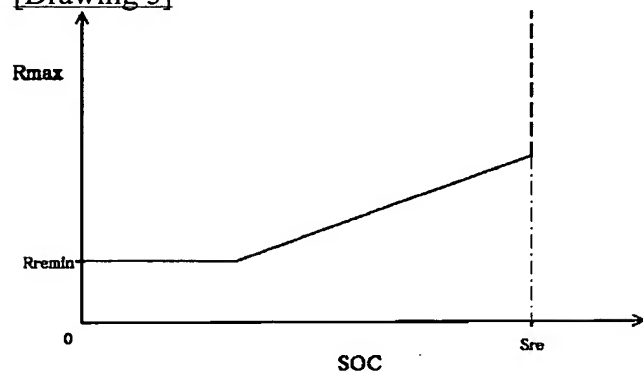
[Drawing 2]



[Drawing 4]



[Drawing 5]



[Translation done.]